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"A STUDY OF STATUS AND RELATIONSHIP OF SOME SELECTED ANTHROPOMETRIC AND BIOCHEMICAL VARIABLES OF NATIONAL LEVEL WRESTLERS"

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ABSTRACT :

Wrestling is highly demanding sport which is dominated by high anaerobic power, high anaerobic capacity, high muscular endurance, average to above average aerobic power, and normal flexibility. It has been widely referred that bodily characteristics, especially anthropometric measurements and body composition, have always affected the performance of the wrestlers. The present study was aimed to investigate the status of selected anthropometrical and biochemical variablesof the wrestlers and to find the relationship between the two. It was hypothesized that; the anthropometrical and biochemical statics are within the normal range and the relationship exists between macro level and micro level composition of the body. Total 133 subjects of age 20 years or more were recruited for the study. out of 133 participants 64 were male and 69 were female. National or international wrestlers across India with the training age of more than 10 years was one of the inclusion criteria for choosing subjects for the study. All the participants underwent anthropometric measurements including height, weight, sitting height, diameter of humerus, wrist, femur & ankle. This was followed by the circumference measurements at various sites, skinfold measurements and measurements of body composition. Pearson's correlation of coefficient (r) was used to find out the correlation among the selected variables while student 't' test was used to find out the significant difference among male and female wrestlers. The level of significant was kept at p = 0.05. Study concluded that there was no statistical relationship between most of the variables of body composition and variables of lipid profiles.

Key Words: *anthropometry, body composition, lipid profile, wrestlers.*

INTRODUCTION

Understanding of body composition and lipid profile has remained a focal point for better living of human being. The study of body composition and lipid profile is not just about living longer but also for healthier living. The knowledge of different constituents of human body is important, but more important is to know relationship among different constituents of human body – especially, the correlation of body composition and lipid profile. And it is twice as important in the field of sports, wherein the extra efforts of human being are required to be a success story. Partitioning of human body at a macro and micro level and then to see the relationship thereof, seemingly, is an important process of analyzing human body.

The assessment of body composition is quite common in the field of sports performance. With a good understanding of our body composition, we can improve our health and change our life for the better. Body composition is what our body is made up of. This is, essentially, how much of our body is consist of fat and lean mass. There may be different levels to measure the body composition such as atomic, molecular, cellular, tissue and system, and whole body (Eston, Howes, Martin, & Reilly, 2009). There are good reasons to assess other constituents of the body, but much interest still centers on the fatness and leanness of the human body. Body mass index (BMI), Somatotyping, Bone mass, Muscle mass, Fat mass and Lean body mass are some of the key features to be included in the assessment of body composition.

Most of the people may have probably heard that too much fat in the diet is harmful and that storage of excess lipid is a major health concern. Many may also know that lipids are not soluble in water. Few are aware, however, that lipids are also important structural elements and are involved in cell signaling. Fat is stored as triglyceride in fat cells. Scientists describe the tissue containing fat cells as adipose tissues, usually white adipose tissue (WAT), to distinguish it from the brown adipose tissue (BAT) used as a heat source in small animals. Stored fat is considered a long-term energy store, in contrast to glycogen which is considered as a short-term energy store. Excessive fat deposits cause obesity, and truncal obesity is an important risk factor for heart diseases (Vasudevan, 2001). Lipids broadly may be defined as organic compounds which are largely insoluble in water, but freely soluble in non-polar organic solvent like chloroform, ether, and alcohol. Most people are well aware that lipids, colloquially called fats, are very important fuels in the body. Lipid profile is assessed by estimating the total cholesterol, high-density lipoprotein (HDL) cholesterol, low density lipoprotein (LDL) cholesterol, triglycerides (TG), very low-density lipoprotein (VLDL) cholesterol, hemoglobin (HB) and fatty acids. Human lipid stores in the human body are huge compared to carbohydrates which is another important and readily available fuel for exercise. Moreover, considering the importance of carbohydrates as a fuel for brain, it is important that fat is used while doing exercise (Huston, 2006).

When we exercise, we put a huge demand of Adenosine Tri-phosphate (ATP) on our skeletal muscles. The lipid used for fuel by muscles comes from free fatty acids (FFAs); which are released from the adipose tissues. Most of the fat in a human body is stored in the specialized cell known as fat cells or adipocytes. When metabolism require energy and energy needs to be increased, nerve and hormonal signals cause triglyceride molecules to be broken down, and fatty acids are released to be used as fuel by the body. Small amount of fat is also present in the muscle cells in the form of triglycerides. And, this Intra muscular triglyceride, which is also an important source of fatty acids, may be used as fuel for exercise. Therefore, Intramuscular triglyceride is, also, available as a fuel for the muscle fibers while doing exercise.

Skeletal muscles contain variable amounts of lipid droplets that tend to be located between myofibrils close to mitochondria (Watt, Heigenhauser, and Spriet., 2002). A third possibility of use of fat as fuel for exercise is FFA released by plasma triglyceride. Lipoprotein lipase activity shows a strong positive relationship with regularly performed physical activity. In fact, lipolysis is favored under condition of increased energy need by the human body such as exercise.

Wrestling is highly demanding sport which is dominated by high anaerobic power, high anaerobic capacity, high muscular endurance, average to above average aerobic power, and normal flexibility (Horswill, 1992). Aerobic refers the presence of oxygen (O2) and anaerobic, here, means the absence of oxygen. It has been widely referred that bodily characteristics, especially body composition, have always affected the performance of the wrestlers. The regime of the training of the wrestlers is to do interval training to develop anaerobic capacity and continuous slow pace training to develop aerobic capacity. As competitions are matched

by body weight; therefore, optimal body composition, to perform better, is very important to maintain. The wrestlers, generally, are mesomorphs when we think about the somatotypes of the wrestlers (yoon, 2002).

Training regime and duration suggest that the wrestlers are likely to have changes in their circulating fat due to the training. The relationship between body composition and lipid profile of wrestlers would be an interesting parameter to work on and to contribute in the sports at national and international level. Current study was conducted with the aims to investigate and describe the anthropometrical and biochemical variables of the wrestlers. And to find the relationship between them. It was hypothesized that; the anthropometrical and biochemical statics are within the normal range and the relationship exists between macro level and micro level composition of the body.

Study will help as a guide to the coaches. It will help in preparing training zones for wrestlers.

It will develop a bench mark of optimum parameters of bodily characteristics for future champion wrestlers. It will help in making a training schedule for wrestlers. It will help in fixing the performance factors of wrestling performance. It will be a great motivation for further research in various fields of human performance.

METHODOLOGY AND RESULTS

Subjects:

Total 133 subjects of age 20 years or more were recruited for the study. Out of 133 participants, 64 were male and 69 were female. National or international wrestlers across India with the training age of more than 10 years was one of the inclusion criteria for choosing subjects for the study. Unhealthy wrestlers, who were not following the wrestling training regime were not included in the study. wrestlers who were banned by the appropriate authority for dope violations and the one who were in transitional period of training were also excluded.

Parameters	Male			Female		
	N	Mean	SD	N	Mean	SD
Height (cm)	64	169.21	7.42	69	159.85	5.97
Weight (kg)	64	76.01	11.70	69	56.66	7.33
Sitting Height (cm)	64	89.01	3.39	69	84.02	2.65

Table 1: mean height, weight and sitting height of male and female wrestlers

Procedure:

Anthropometric data of all the participants were taken with standard tools and procedure. This include height (barefooted and against the wall) recorded to the nearest of 0.1 cm, bogy weight (without shoes and minimal clothing) recorded to the nearest of 0.1 kg.

Anthropometer was used to measure sitting height. Sitting height was taken as the distance from the vertex of the head to the base of the sitting surface when the seated subject was instructed to sit tall to the nearest of 0.1cm. Sliding caliper was used to measure the diameter of bicondylar humerus (distance between medial and lateral epicondyles of humerus), wrist (distance between styloid process of the ulna and radius with hand pronation and elbow flexion), femur (distance between the most medial and lateral aspects of the femoral condyles in flexed knee) and ankle (maximum distance between the most medial and lateral malleoli while subject stood erect with evenly distributed weight over both the feet) (Table 2).

Diameters (cm)	Male			Female		
	N	Mean	SD	N	Mean	SD
Humerus	64	7.22	0.48	69	6.33	0.45
Wrist	64	5.83	0.37	69	5.20	0.29
Knee	64	10.26	0.70	69	8.98	0.52
Ankle	64	7.18	0.50	69	6.28	0.64

Table 2: Diameter of humerus, wrist, knee and ankle of male and female wrestlers

Soft metric tape was used to measure circumference of upper arm in neutral (N) and in flexed (F) position (arm was abducted to the horizontal in both case), forearm (maximum girth at the proximal part of the forearm), thigh (mid-point between the trochanterion and tibiale laterale), calf (maximum girth area) (Table 3).

Circumferences (cm)	Male		Female	
	Mean	SD	Mean	SD
Upper Arm (N)	33.21	2.82	26.20	2.56
Upper Arm (F)	35.62	2.67	28.51	2.77
Forearm	28.06	1.93	23.87	1.84
Wrist	17.32	1.02	15.26	0.90
Thigh	57.32	3.28	50.07	4.52
Calf	36.41	2.30	32.38	2.12
Ankle	22.05	1.84	20.12	1.43

Table 3: Circumference (in cm) for selected place

Skin fold caliper was used to measure the skin folds various regions including biceps (exactly halfway between the olecranon and acromion process, triceps (exactly halfway between the olecranon and acromion process), forearm (just below the elbow joint), subscapular (oblique skin fold below the inferior angle of the scapula, approximately 45 degree to the horizontal plane), suprailiac (Diagonal fold taken immediately above the crest of the ilium), supraspinale (diagonal fold, just above the crest of the ilium from the anterior axillary fold), abdomen (Vertical fold at the lateral distance of approximately 2 cm from the umbilicus), Thigh (vertical skin fold in the anterior aspect of the mid-way thigh) and calf (Vertical skin fold was taken at the medial aspect of the calf) (table 4).

Skin folds (mm)	**Male**		**Female**	
	Mean	SD	Mean	SD
Biceps	4.41	1.63	5.71	1.86
Triceps	10.92	3.73	13.75	3.87
Forearm	7.10	2.16	7.33	2.29
Subscapular	16.15	5.56	14.12	4.28
Suprailiac	14.89	5.56	11.32	5.36
Supraspinale	8.23	3.96	7.29	3.28
Abdominal	21.03	6.87	16.25	5.53
Thigh	12.79	4.30	17.90	5.49
Calf	8.21	3.05	11.80	3.59

Table 4: Skin fold measurement (in mm)

Composition of body analysis including somatotyping was derived mathematically.

Endomorphy is estimated from the relation between the component value and the sum of three skin fold measures, relative to the subject's height. Mesomorphy is estimated from the deviation of two girths and two breadths from their expected values, relative to the subject's height. Ectomorphy is estimated from the relation between the component value and the reciprocal of the ponderal index, or height over cube root of weight ratio.

Body Compositions	Male		Female	
	Mean	SD	Mean	SD
Height- Weight Ratio	40.08	1.18	41.72	1.57
Endo- morphy	4.23	1.16	4.17	1.14
Meso-morphy	6.92	0.95	4.51	1.12
Ecto-morphy	1.00	0.57	1.98	1.03
Bone Mass (%)	15.67	1.10	15.30	1.51
Muscle Mass (%)	48.70	3.54	41.25	3.71
Fat (%)	17.39	3.27	24.12	3.83

Table 5: derived variables (Body composition) of male and female wrestles

Lipid Profile testing and methodic there of including Serum Triglyceride was assayed by the method of Werner M et al. (1981), Serum Cholesterol was assayed by the method of Allian et al., (1974), Serum HDL-Cholesterol was assayed by the method of Izzo et al. (1981), Serum LDL cholesterol (LDL-C) and VLDL cholesterol (VLDL-C) were calculated by means of Friedewald equation (Friedewald et al. 1972)

Biochemical Parameters	Male		Female	
	Mean	SD	Mean	SD
Cholesterol	173.39	25.40	168.02	17.23
Triglycerides	124.43	69.01	111.96	26.03
HDL-Cholesterol	52.53	8.16	52.22	7.85
C/H Ratio	3.36	0.64	3.29	0.61
VLDL-Cholesterol	24.88	13.81	22.40	5.20
LDL-Cholesterol	95.97	17.04	93.40	18.59
Hb	14.67	0.85	11.59	0.77

Table 6: Biochemical variables of male and female wrestles

Statistical Methods Used

Pearson's correlation of coefficient was applied to find out the relationship among the variables, while student paired 't' test was used to find out the gender differences among the parameters.

Body Composition	**Cholesterol**	Triglycerides	HDL-Cholesterol	C/H Ratio	VLDL-Cholesterol	LDL-Cholesterol	Hb
Height-Weight Ratio	.132	-.020	.068	.053	-.020	.180	-.184
Endo-morphy	-.029	.021	-.103	.045	.021	-.012	.221
Meso-morphy	-.067	.149	-.104	.028	.149	-.171	.229
Ecto-morphy	.111	.006	.019	.072	.006	.152	-.162
Bone Mass (%)	.334**	.265*	.059	.237	.265*	.254*	-.062
Muscle Mass (%)	-.072	-.072	.120	-.156	-.072	-.107	-.214
Fat (%)	.021	.073	-.109	.091	.073	.024	.270*
Lean Body Mass (%)	.133	.302*	-.166	.235	.302*	.033	.377**
df=62 & p value at 0.05=0.246; 0.01=0.321							

Table 7: Pearson's coefficient of correlation (r) among lipid profile and body composition of male wrestlers (n = 64) (*significant at 0.05 level)

Pearson's correlation among various variable of lipid profile and body composition of male wrestlers raveals significant relationship of bone mass with cholesterol (r = 0.334), triglycerides (r = 0.265), VLSL (r = 0.265) and LDL (r = 0.254). Fat percentage reveals significant relation only with Hb (r = 0.270). And lean body mass was found to be significant correlated with triglyceride (r = 0.304), VLDL (r = 0.302) and Hb (r = 0.377). while all other parameters have not shown any significant correlation among each other.

Body Composition	**Cholesterol**	Triglycerides	HDL-Cholesterol	C/H Ratio	VLDL-Cholesterol	LDL-Cholesterol	Hb
Height-Weight Ratio	-.223	-.036	.104	-.175	-.035	-.241*	.026
Endo- morphy	.049	-.048	.006	.015	-.047	.057	.129
Meso-morphy	-.007	-.079	-.050	.018	-.079	.036	.018
Ecto-morphy	-.201	-.006	.142	-.192	-.006	-.245*	-.078
Bone Mass (%)	-.308*	-.015	.040	-.170	-.015	-.298*	.009
Muscle Mass (%)	-.232	-.100	.150	-.264*	-.101	-.250*	.166
Fat (%)	.011	-.045	-.015	.014	-.044	.029	.110
Lean Body Mass (%)	-.059	.094	-.037	-.021	.094	-.066	.113
df=67 & p value at 0.05=0.237; 0.01=0.308							

Table 8: Pearson's coefficient of correlation (r) among lipid profile and body composition of male wrestlers (n = 69) (*significant at 0.05 level)

Pearson's correlation among various variable of lipid profile and body composition of female wrestlers ravels significant relationship of HWR with LDL (r = 0.241), Endomorphs with LDL (0.245), bone mass with cholesterol (r = -0.308) & LDL (r = 0.298). Muscle mass is found significantly correlated with C/H ration (r = -0.264) & LDL (r = -0.250). While all other parameters have not shown any significant correlation among each other.

Parameters	t-test	P value	Sign.
Cholesterol	1.437	0.159	NS
Triglycerides	1.398	0.178	NS
HDL-Cholesterol	0.225	0.822	NS
C/H Ratio	0.627	0.531	NS
VLDL-Cholesterol	1.355	0.179	NS
LDL-Cholesterol	0.833	0.406	NS
Hb	21.781	0.001	S*

Table 9: t-test for gender differences among lipid profile variables.

Table 9 revels that none of the lipid profile parameters show significant difference among male and female wrestles except Hb which is found to be significantly different at the level of 0.05.

Parameters	t-test	P value	Sign.
Height- Weight Ratio	6.880	0.001	S*
Endo- morphy	0.259	0.796	NS
Meso-morphy	13.411	0.001	S*
Ecto-morphy	6.892	0.001	S*
Bone Mass (%)	1.600	0.112	NS
Muscle Mass (%)	11.849	0.001	S*
Fat (%)	10.931	0.001	S*
Lean Body Mass (%)	8.211	0.001	S*

Table 10: t-test for gender differences among body composition variables.

Table 10 revels that all the body composition parameters except endo-morphy and bone mass (%) shows significant different values for male and female wrestlers at the level of 0,05.

DISCUSSION

The present study entitled was conducted on 133 subjects, consisting of 64 male and 69 female wrestlers. The study was aimed at finding out the relationship between selected variables of anthropometrical and biochemical make-up of the wrestlers.

The mean value for the cholesterol of the total 133 subjects was found to be 170.60 while the mean values of triglyceride, HDL – Cholesterol, C/H ratio, was estimated at 117.96, 52.37, and 3.33 respectively. VLDL Cholesterol, LDL- Cholesterol, Hb, and Height – weight ratio had a mean value of 23.59, 94.64, 13.07, and 40.93 respectively.

Although, wrestling sport is a weight category sport where height was not supposed to matter much, but its impact on certain other derived variables can't be ruled out. The mean values of height of the male and female wrestlers were estimated at 169.21 cm and 159.85 cm respectively. The weight, which is an important variable in the sport of wrestling, depicted the mean values of 76.01 kg and 56.66 of the male and female respectively. Mean sitting height of male and female were calculated at 89.01cm and 84.02cm respectively. The value of male is more than the female one (table 1). Mean values of diameter of humerus for male and female wrestlers were calculated as 7.22 cm and 6.33 cm respectively. The table No. 2 has shown that male wrestlers have got, evidently, higher value of bi-epicondylar humerus breadth than female. The diameters of wrist for male and female have been derived as 5.83 cm and 5.20 cm respectively (Table No- 2). The value is suggesting that female's measurement of wrist is less than that of male. The breadths of the biepicondular femur (knee) have been computed at 10.26 and 8.98 of the male and female respectively (Table No- 2). The breadths of the ankle have been estimated at 7.18 and 6.28 for male and female respectively, wherein, the value of male counterpart is more than the female (Table No- 2). The mean girth of the upper arms (relaxed) was calculated at 32.21cm and 26.2 cm for male and female respectively. The girth of the male is obviously greater than female (Table No. 3). The table No. 3 has depicted the mean values of upper arm's girth (Flexed) as 35.61cm and 28.51cm for male and female respectively. The circumferences of fore-arm for male and female have been measured at 28.06 cm and 23.87cm respectively (Table No. 3). The girths of wrist, thigh, calf and, ankle for male were measured at 17.32 cm, 57.32 cm, 36.41 cm, and 22.05 cm respectively while for females, the measurements were 15.26 cm, 50.07 cm, 32.38 cm, and 20.12 cm respectively. All the circumferences of male are greater than the female counterpart (Table No. 3). The values of the biceps, triceps, forearm and subscapular, for male were recorded at 4.41 mm, 10.92 mm, 7.10 mm, and 16.15 mm respectively. But the values of the same for female were estimated at 5.71 mm, 13.75 mm, 7.33 mm, and 14.12 mm which are higher in female. The values of superailiac, supraspinale, abdominal, thigh, and calf for male were computed at 14.81 mm, 8.23 mm, 21.03, 12.79, and 8.21 respectively. But, same for female were recorded at 11.32 mm, 7.29 mm, 16.25 mm, 17.90 mm, and 11.8 mm respectively (Table No. 4). Mean values of height weight ratio, endo-morphy, meso-morphy, ecto-morphy for male were recorded at 40.08, 4.23, 6.92, and 1.00 respectively while for female the mean values of the same were estimated at 41.72, 4.17, 4.51, and1.98 respectively (Table No.4). As to the mean values of bone mass%, muscle mass%, and fat% for male, the study recorded the values at 15.67, 48.70, 17.39 respectively while the values for female were estimated at 15.30, 41.25, 24.12 accordingly (Table No. 5). A review done by Charter (1970) indicate that somatotype patterns are narrower the higher the level of competition. On the basis of the study done by Kroll in 1954, it was indicated that the body type for the wrestlers studied was far different from the short-legged, bulky muscled, extreme mesomorphic physique considered ideal. The wrestlers tended toward being an ectomorphic-mesomorphic body type, possessing body type characteristics of an agility athlete.

The table No. 6 has shown the mean values of cholesterol, triglycerides, HDL-cholesterol, and C/H ratio as 173.39, 124.43, 52.53, and 3.36 respectively for male. Accordingly, the same values for female have been

recorded at 168.02, 111.96, 52.22, and 3.29. Moreover, the mean values of VLDL-cholesterol, LDL-cholesterol, and hemoglobin (Hb) for male were estimated at 24.88, 95.97, and 14.67 respectively. However, the same values for female were calculated at 22.40, 93.40, and 11.59 respectively (Table No. 6). Increased HDL-cholesterol values and decreased VLDL- and LDL-cholesterol values were found in athletes with a rising oxygen-uptake; a significant, age-related increase in HDL-cholesterol occurred only in endurance-trained persons (Berg et al., 1974). Research also suggest the association between total body fat and serum concentration in obese adolescents (Choil, Pai and Kin, 2002). Research also suggest no relationship was anaerobic parameters and fat mass as well as no association between anaerobic parameters and fat mass (Vardar et al., 2007)

The results were showing that almost all the different variables of body compositions were on the expected lines when they were compared with the other top wrestlers of the same age from other wrestling nations. The result of different biochemical variables was also falling within the normal values of same age counterparts.

When relationship of body composition and lipid profile was analyzed it was found that there was no relationship existed between the two. However, some of the variables have shown the statistically significant relationship between body composition and lipid profile.

And independent samples t-test was conducted to compare the selected anthropometrical and biochemical variables of males with that of females. However, most of the variables no statistically significant difference was reported.

Study concludes that there was no statistical relationship between most of the variables of body composition and variables of lipid profiles. More studies are required to see the intra-relationship of different levels of body composition. It is difficult to predict the micro level values of the body composition by looking at the macro level body composition. Descriptive statistic suggests that most of the values of the lipid profiles are falling within the normal range.

Muscle mass and somatotype values of the Indian wrestlers are very encouraging especially, meso-marphy component.

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